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Feasibility and Reliability of Grain Noise Suppression in Monitoring Highly Scattering Materials Using Baseline Subtraction

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This paper studies the feasibility and reliability of using the baseline subtraction method [1] to suppress grain noise in monitoring highly scattering materials. Monitoring is usually done with permanently installed sensors but this is not always possible and here we investigate the feasibility of subtracting A-scans extracted from repeat C-scans. It is important that the transducer standoff and angle relative to the testpiece are set consistently in the repeat scans and the influence of errors in these settings has been investigated. The successive C-scans can be registered by cross correlation and the effect of errors in the registration is illustrated. The experimental results, shown in Fig 1, demonstrate that the residual grain noise after baseline subtraction is around 15dB lower than the original grain noise; this will give a significant improvement in defect sensitivity. Successive tests may be carried out at different temperatures and with different transducers of similar specification. Compensation methods for temperature variations [2] and transducer frequency response changes are then proposed, and their effectiveness is tested experimentally. The addition of these two effects reduces the typical improvement in the signal to noise ratio obtained via baseline subtraction to about 10 dB which is still potentially valuable in some applications.

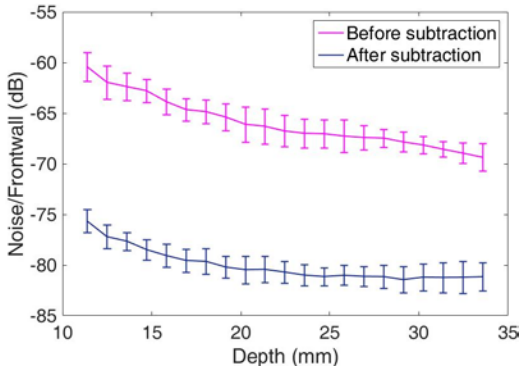

Figure 1. Average noise level of the current signals (collected after resetting the transducer) over the thickness of the sample before and after baseline subtraction. Error bars show the standard deviation of results at ten positions on the sample.

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References:

1. K. Worden, C. R. Farrar, G. Manson, G. Park, “The fundamental axioms of structural health monitoring,” in *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **463**, 1639-1664 (2007).
2. J. B. Harley and J. M. F. Moura, “Scale transform signal processing for optimal ultrasonic temperature compensation,” in *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, **59**, 2226-2236 (2012).